

THE DETERMINATION OF
INFORMATION REQUIREMENTS OF A
MARINE CORPS COMMUNICATION MANAGER

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THESIS

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INFORMATION REQUIREMENTS OF A
MARINE CORPS COMMUNICATION MANAGER

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The Determination of Information Requirements of a
Marine Corps Communication Manager

by

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ABSTRACT

The increasing complexity of communications systems management is introduced and the framework for a solution to management problems is presented in the form of a management information system.

The role and value of information in an organization are shown so as to highlight the benefits of a well designed information system. The mission and objectives of an information system are defined to serve as guidance for the managerial aspects of the design effort.

A method is developed to analyze a system by identifying the general elements of information required by a manager around which a computer-based information system could be designed. This procedure is applied to the Marine Corps communications system, resulting in a detailed description of the functions of the communications manager. Further analysis determines the elements of information required to perform these functions.

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I. INTRODUCTION

A. THE EXPANDING COMMUNICATIONS SYSTEM

Management systems are organizational tools used by managers to cause an organization to function. They include the methods, procedures, concepts, and tools used by the manager. It is because of their importance that the development of effective management systems should lead all other forms of systems development. For example, in the design of information systems which are a part of management systems, there has been too little emphasis on exactly what management needs, and too much attention to the system's electronic computer [Ref. 1]. State-of-the-art management systems which incorporate the latest in analysis techniques, management procedures and automated information systems are essential prior to the installation of state-of-the-art hardware and implementation of operational systems that create a multitude of new management problems.

In this vein, a continuous fault with communications organizations has been the development and implementation of new communications methods and equipment without the required management systems necessary to fully utilize them. In the past this was not a complete hindrance, but it forced management to operate in a brush-fire mode, moving quickly from one crisis to another. The military communications manager has adapted to this method of operations so that the

communications systems continued to function and provide required support.

The Marine Corps has been fortunate to have a succession of capable individuals in the communications field with years of operational experience, foresight, good judgment and ability in the key management positions. These men were able to put together and manage major communications systems anywhere in the world primarily as one man shows. These days are gone, not because the man has changed, but because the environment is such that communications systems require a coordinated team effort with inputs from many fields of expertise. The system has become so large and complex that even the most knowledgeable manager can no longer rely only on his intuition and experience to deal with questions of optimum resource allocation, system design, and overall system operation. Since relatively simple communications systems are gone, the problem has become a question of how to achieve and maintain an optimum, highly complex, and adaptive communications system that must cope with problems such as:

1. An increase in conventional voice and teletype traffic.
2. An increase in digital traffic.
3. Complex equipment and systems.
4. Trained personnel shortages.
5. An increased requirement for circuit quality.
6. Increased RF spectrum congestion.

B. THE INCREASED IMPACT OF COMMUNICATIONS SYSTEMS

In today's world of general unrest, there will continue to be political and military confrontations that are initially limited in scope but have the potential to erupt into a nuclear holocaust. In this type of world environment, the most probable employment of Marine Corps combatant forces will be as forces-in-readiness with the mission of responding quickly to tense, rapidly changing crises. They will be called upon to execute a variety of operations that have a direct effect on the crises and, as a result, will be under great pressure to accomplish the assigned mission without triggering a more serious emergency. In such situations, where the atmosphere is highly explosive, the forces involved must be tightly controlled both by the National Command Authority and the local tactical commander. These conditions make it imperative that vital information and important decisions be relayed to the users in a matter of minutes or even seconds.

Since the communications system is the primary means for performing this critical transfer of information, it is raised to a new level of importance. A point has been reached where the impact of communications is so great that the capability of the commander to carry out his mission is a function of the quality and extent of the supporting communications system.

C. THE INCREASED NEED FOR INFORMATION

In order to employ modern management techniques there must be adequate information upon which to act. A prime inhibitor to fully implementing improved management practices throughout the military communications system and in the Marine Corps system in particular is the lack of accurate and timely information, a lack that is potentially paralyzing to management.

In the past, information to support the communications manager has been acquired by one-time collection efforts and maintained by laborious manual methods. While these efforts minimally satisfied urgent information requirements, they do not contribute to the overall efficiency of the system. It is not always obvious to military communications managers that the application of information technology, meaning a management information system, is the answer or even part of the answer to improved information. Even worse, the proper techniques to employ in developing an information system are not obvious [Ref. 2].

D. THE OBJECTIVES OF THE STUDY

The Commandant of the Marine Corps has directed that automated command and management systems be developed and in 1969 issued a master plan to guide their design and implementation. Following this guidance, several administrative systems have been implemented with several under study that cover various areas of command and control.

In all of this effort, little has been done toward the design of information systems to satisfy the need of the communications manager for better information despite the importance of the communications system. It is the purpose of this study to present initial analysis that will eventually lead to a solution to this problem and pave the way for a future computer-based management information system specifically created to support the communications manager.

The study was undertaken with the following objectives:

1. To adapt systems analysis procedures that are a part of information technology to the Marine Corps tactical communications system.

2. To identify the elements of information that are required by a Marine Corps communications manager to carry out his responsibilities in a tactical environment.

3. To define the Marine Corps communications system and establish general objectives for it that contribute to more efficient and effective performance.

4. To define the functions of a Marine Corps communications manager as a basis for identification of the information needs.

E. ASSUMPTIONS CONTAINED IN THE STUDY

The first assumption, carried through the study, is that a general organization, not any one specific unit, is being described. There are many minor variations between units caused by differences in personnel,

situation, and location which cause slightly different managerial functioning. The general organization is adapted to smooth out these variations and make the results of the study more applicable.

The second assumption, inherent in the objective, is that the information system developed to support the communication manager will be based on a large scale, random access, electronic computer. The communication system is too large, complex, and dynamic to be supported by any other type of system.

F. THE BASIC APPROACH

In order to achieve the study objectives, the following approach was taken. The latest concepts in computer-based management information systems, gleaned from the writings in the field, have been combined with the author's firsthand experience as a communications manager to develop the method of analysis. The analysis performed was supported by interviews with eleven experienced Marine Corps communications managers.

Since the objectives of the study are management oriented, there has been no consideration of the detailed technical means of providing such a system nor has an entire design cycle for a management information system been completed.

This study will first examine the foundation for information system design. It will then look at systems analysis methods that are used to design information systems. Following this, the Marine

Corps communications system and functions of the communications manager will be explored. The principal discussion areas will be followed by some conclusions drawn from the study.

II. THE FOUNDATION FOR INFORMATION SYSTEM DESIGN

A. INFORMATION AS A RESOURCE

1. The Definition of Managerial Information

The term "information" has been bandied about a great deal with several different connotations attached. One of the biggest obstacles to a successful information system is the lack of appreciation for the real concept of information. For this reason a more formal definition is needed that can be used to guide system design [Ref. 3]. One author has described information as the glue that holds the organization together [Ref. 4]. Although true, this definition does not provide the clear, systematic statement that will be of use to the systems designer.

As a basis for the definition of information, data is defined to be a fact in isolation. Information is defined as an aggregation of facts or data organized and utilized to be meaningful knowledge or intelligence. Information is meaningful in the sense that it relates otherwise meaningless data to some specified human purpose or objective [Ref. 5]. Information is the raw material that goes into the decision processes that govern the behavior of an organization.

2. The Value of Information

The total value of information is derived from its effect on behavior [Ref. 6]. Katz emphasized this point when he said, "It is

perhaps trite to observe that information is of no significance if no one looks at it. Unless after looking at the information, someone makes a positive decision, the information is still of no value." [Ref. 7]

The manager is the user of information, the one who looks at the information and through decisions, converts it into action. This process is the foundation of all management functions in a communications system. A means of providing the information to the manager so he can function is needed. This is where the concept of a management information system becomes germane.

B. THE MANAGEMENT INFORMATION SYSTEM

1. The Concept of a Management Information System

There is a great deal of confusion about what a management information system is and what it does. This has arisen because the term has been applied to many widely differing activities and concepts in the electronic data processing field. As a preliminary step in the determination of information requirements, it is necessary to define the concept of an information system to insure congruence of overall system design goals.

The best concept of a management information system is an ordered arrangement that will enable the manager to take a more global view of his responsibilities without sacrificing more immediate and local needs. Insofar as a system can do this it should be able to play the role analogous to that of an intelligent aide or staff, presenting

the manager the information he needs and assisting him in the exercise of his responsibility [Ref. 8]. It serves as a management tool that aids management in making, executing, and controlling decisions by providing information responsive to management needs at all levels.

There are two erroneous attributes often given to management information systems. An information system does not make management decisions. It can help to solve problems, control processes and present information but does not take over the responsibility for managerial decisions. In some cases, the decision process can be automated, but it is still the manager's decision. In addition, the system is not a vast array of all possible information that can be retrieved, manipulated, and displayed at will. Associated with an information system, there will normally be a data base which consists of a generalized type of file that contains a carefully chosen set of data elements common to the entire information system. It should be recognized that the data base is far from comprehensive and can only be manipulated by very narrow, precise rules that are dictated by technical constraints.

2. The Mission of an Information System

Once the concept of an information system is in hand, the mission follows naturally. The purpose of a management information system is to provide each level and position of management with all the accurate, up-to-date information that is needed to conduct managerial tasks in a timely manner. There are two elements to

this mission, filtration and condensation [Ref. 9]. The information system should filter the information so that each level and position receives only the information it can act on and only when action is possible and appropriate. This does not necessarily mean limiting the scope of the information presented to any manager. There could easily be cases, for instance in a planning cycle, where the information that should be acted on would be a broad overview of some aspect of the organization. The idea is to eliminate the deluge of extemporaneous and largely irrelevant information to which the manager is subjected. Along the same lines, the information system should condense the myriad of detail into a meaningful, easily understood form that fulfills the actual needs of the manager. The degree of condensation would depend on the level of management and would not preclude the presentation of any degree of detail.

3. The Objectives of an Information System

From the mission statement the objectives of the information system can be derived. Clear objectives must be set so the information system focuses on the major problems and activities of the organization. They must coincide with the objectives of the organization in a supporting and complimentary role [Ref. 10]. The objectives of the communications system will be discussed in detail later but an examination of the general objectives of the information system is necessary.

In keeping with a general goal of increasing the efficiency and effectiveness of the manager, specific objectives for an information

system can be established as follows:

1. To improve the quantity, quality, speed, and form of the information provided to the manager.
2. To make possible quicker actions on managerial decisions.
3. To improve the coordination between individual managers and separate segments of the organization.
4. To provide for control by exception.
5. To automate routine decision-making when possible.
6. To evaluate information required for non-routine decision making.
7. To eliminate routine clerical work by the manager [Ref. 11].

A second type of objectives are those that measure the technical performance of the system. These objectives are stated in terms of the degree of attainment of the general objectives. If the general objectives are not measurable directly, they must be broken down into detailed parts which can be quantified and measured [Ref. 12]. While very important, the detailed objectives do not impact directly on initial planning and development efforts. They are usually defined later in the design process prior to hardware considerations.

III. A METHOD OF ANALYSIS

A. A GENERAL DESIGN CONCEPT

1. The Design Objectives

The design of an information system is a creative process that varies from person to person and situation to situation. However it is not an unstructured, hazy cloud of activities and ideas; there is a common thread which runs through all design efforts. This thread is an understanding of the development process itself, of what the outcome should be and generally what is necessary to achieve this result [Ref. 13]. By understanding the design effort, the specific steps of the analysis procedure can then be structured to meet the needs of the situation and the inclination of the individual performing the analysis.

The focus is again on objectives as aids to understanding an activity. There are objectives established by top management that guide the design process. The following discussion highlights the most important of these in generalized forms that are applicable to all organizations.

The first objective is to avoid overlapping of major components of the system which are widely applicable across organization lines. This objective is directed toward making efficient use of the

resources available and should be a major consideration when there are no compelling functional or technical reasons for separate sub-systems.

In a similar vein, the second objective is to reduce or eliminate the total number of small, isolated systems operated and maintained in an organization. This objective addresses the small, in-house systems that proliferate in a large organization and is attained by combining the functions of the small systems into one larger, more economical system.

The last objective could be the key to a successful system. The objective is to provide adaptability of the system to change and growth without the need for major overhaul. The degree to which this objective is attained revolves around an economic decision, because adaptability is a characteristic that tends to be very expensive [Ref. 14].

2. Approaches To Design That Have Been Used

Important to an understanding of the design process is a consideration of the ways the design problem can be approached. The design of information systems have been done basically in two ways, either using a "top down" approach or a "bottom up" approach. The "top down" approach can be described as originating in an analysis of the decision process used by managers. The results of this analysis is then used to determine the information required for rational decisions. The alternate approach that has been used is the "bottom up"

method. This general approach starts with existing unautomated systems and seeks to expand, refine and automate these to fill immediate, specialized needs. It assumes a long range plan will assure the integration of the specialized systems as they are developed so they will eventually produce information for the manager. In the meantime, the specialized systems will serve existent needs and accrue short range benefits [Ref. 15].

The failures that have been experienced with the "top down" approach result from the decision process being dynamic. The critical decisions in any organization will change with time as will the information required to make the decisions. The methods by which decisions are made will vary with changes in the current situation and differences in personnel. As a consequence, a system designed solely on the basis of currently perceived needs may lock the organization into the situation and modes of operation that existed at the time the system was designed. This strong tendency to lock the organization into a rigid mode of operation that can rapidly become obsolete is likely to cause many missed opportunities.

The failures of the "bottom up" approach are mostly related to the difficulty in achieving any real integration of the multitude of systems that spring up over a period of time. Key decisions on system design are made early in the development cycle, primarily on the basis of low-level requirements that appear in a restricted

context. These decisions can easily lead to incompatible systems and other inconsistencies that economically and technically preclude any later integration [Ref. 16].

3. An Approach with a Different Perspective

A third approach is needed that will use the best parts of the "top down" approach while avoiding their obvious pitfalls. The approach should focus on the general aspects of managerial needs. The guiding concept that must be embedded in the framework of information system design is to look at the key functions of the manager, not specific decisions [Ref. 17]. If this is done, the final design of an information system should be very analogous to a biological nervous system that has a specific purpose; to collect and analyze data that supports the basic life cycle of an organism. The objectives of the total organism change quite often with little change occurring in the structure of the nervous system. Instead there is a generalized adaptation of the system to the immediate objectives. The management information system should be designed to support the basic life cycle of the organization while organizational objectives change. This takes the best part of the "top down" approach by keeping the system strictly oriented toward management needs and adds an element of adaptability.

To utilize the best part of the "bottom up" approach, the effort should produce a design that can be implemented sequentially,

each part standing substantially alone but adding new capability.

This accomplishes two purposes. The operation of the organization is not totally disrupted and the major expenditure of capital can be extended over a period of time. The important factor is to insure that each part of the system, as it is implemented, is a part of the total system and does not become a separate, divergent system.

This principle-oriented approach is the most fruitful when dealing with systems that tend to change fairly regularly. Once this approach is understood, the design process is well in hand and the methods that will be employed to analyze the organization can be developed.

B. A PROCEDURE FOR ANALYZING THE SYSTEM

1. Problems of the Development Effort

It would be a straightforward effort to identify information requirements of a specific communications system that is in a more or less stable operational status. Well defined, previously tested techniques could be used with few modifications. However, it must be recognized that a tactical communications system is highly dynamic in nature, changing often to meet new situations. Compounding this problem is the fact that the system must function fully when the tactical organization is engaged in combat operations. In addition, the system is never the same each time it is brought into existence.

The development of techniques to determine the information requirements of systems not yet defined poses many conceptual and developmental problems. How and where to start, what techniques to employ, and a spectrum of other questions must be answered.

2. Analysis Based on Management Functions

Krause defines systems analysis as, "..... studying the problem to define exactly what the system should do a determination of the user functional requirements." [Ref. 18] Just as there are different approaches to design, there are several ways proposed to conduct a systematic analysis of the system. Martin stresses decision nodes [Ref. 19], Ackoff looks at the major managerial decisions [Ref. 20], and Miller champions the building of a conceptual model based on the key operations of an organization [Ref. 21]. These authors are directed toward the same basic goal, an understanding of the management process as a prerequisite to determining management information requirements. Obtaining this understanding is the heart of the systems analysis process and begins with a fragmentation of the management process into its components. The elements that make up the activities encompassed by the management system must be identified in sufficient detail to enable the designer to define and structure each element while keeping in mind the relationship between the identified task and the overall management structure. To be completely effective the process must disregard both formal and informal

organizational boundaries and consider the management function independently, as an entity in its own right, regardless of where or at what level in the organization it is found.

3. The Steps in the Analysis

The process described is carried out in two steps. The first step in the systematic analysis is the preliminary identification of the principal management functions carried out by the manager. These are not the classical functions, described by Koontz and O'Donnell as planning, organizing, staffing, directing, and controlling [Ref. 23]. When the activity of a manager is studied from the systems point of view a somewhat different set of managerial functions emerge that are more specific and task oriented. These functions stress the general operations carried out by the manager as he discharges his various responsibilities. The output of this step is a list of principal functions of the manager that provide the framework for the next step in the analysis.

The second step in this process is the decomposition of the principal functions into subfunctions that are the activities carried out by the manager. This further fragmentation is done by a study of each major function to determine the elemental tasks that are executed by the manager each time the function is performed. A description of each of these elemental tasks must be developed that stresses the generic nature of the tasks.

During this process, the principle orientation must be closely observed. The easy way out of studying each task and identifying the specific elements of information required for the present organization, time, and situation must be avoided. What must be done is to generalize the functions and subfunctions so they fit the overall responsibility of the manager and are not totally constrained by the current organization and personnel. If this can be accomplished, the information system is well aimed toward success and identification of the elements of information can proceed.

The last step is the analysis of the functional descriptions that have been developed to identify the elements of information required by the manager to successfully perform a function. The analysis is done by carefully examining the output and actual performance of each elemental task so that the inputs to the management activity can be isolated. The process is an iterative one and requires a detailed knowledge of the task; a requirement that makes heavy participation by the management of an organization mandatory.

The type of information needs identified by this process will not be detailed data elements, these are the things that tend to change with time and circumstance. The information need will be general in the sense that a type of information is addressed rather than a specific source. For example, the specific characteristics of machine A and machine B would not be included. Instead the

general classification of characteristics of equipment would be used.

This insures the general requirements of the manager will remain constant even though the detailed data elements that are used to satisfy the requirements are in a constant state of change.

IV. THE MARINE CORPS COMMUNICATIONS SYSTEM

A. ORGANIZATION OF THE COMMUNICATIONS SYSTEM

1. A Systems Approach

The approach to determining information requirements of the communications manager has been established and the method of conducting the analysis of his function has been developed. The next logical step is the application of the process to the communications system. To do this, a conceptual communications system that embodies current operational doctrine must be the starting point for the analysis. This is essential for two reasons. The primary reason is the need to obtain an understanding of the structure of the organization and the relationships between the various functions performed [Ref. 24]. A second very practical reason is that the present system does work and to be of any benefit the new system must work as well or better [Ref. 25]. A discussion of the organizational structure and management system of the present system is then appropriate as background for further analysis.

The current vogue in describing large, complex organizations is to use the systems approach. In this approach to an organization, the total system is a set of elements that are united by some form of interaction or interdependence in seeking a common goal. Orlicky's definition is particularly good when applied to a military

system. He says, "A system is a composite that functions as an entity, and its main attribute is that its utility, or power, is greater than that of its components summed individually." [Ref. 26] The total system for the purposes of this study is comprised of a complete Marine Corps tactical organization with all of its diffuse units and functions. Each of the units and support functions is considered a subsystem that is an entity and as such has an interest in its own right [Ref. 27]. They are united by the common goal of accomplishing the mission assigned to the tactical organization. The units are linked together by a network that ties the total system into a coordinated pattern. These essential links which permit parts of the system to interact with each other and the external environment make up a communications system. In the military tactical environment being studied, this subsystem provides the means of exercising tactical command, operational control, administrative processes, and logistical functions for the total system and within each subordinate unit.

2. The Communications System Concept

The concept of a communications subsystem of an organization is a very broad one and in fact Murdick and Ross feel the total system can be represented by its communications function [Ref. 28]. While this may hold in theory, it is far too broad a context for military communications which fills more of a supporting role.

Even a restricted definition that includes only formal communications of a military nature is too all-inclusive since every element of the total system, down to and including the individual, are involved in giving and receiving orders.

The Marine Corps communications subsystem will be referred to as the "communications system" with the understandings that it is not the top of the hierarchal levels. The communications system can be defined as the organization, activities, and equipment that are required to electrically transmit and receive information within and external to the total system along with any processing incident to the transmission, reception, and distribution to the user. This definition specifically excludes face-to-face exchanges, tactical signalling, and postal-type services. In addition, the origination and use of information is not of direct concern except as it impacts on the communications system. The communications system is basically a technical network that provides the means of interchange of information. Because of the Marine Corps concept of employment, any specific hardware configuration of the communications system is a relatively temporary network, capable of being installed in almost any location in the world. It uses little in the way of fixed, plant type of facilities and can be disbanded completely in a short period of time. Because its primary mission is to support combat operations, it is a highly adaptable and flexible system.

3. The Structure of the Communications System

The organizational structure of the communications system is dictated solely by the organization of the unit it supports. The Marine Amphibious Force or MAF is composed of one or more Marine Divisions and one or more Marine Aircraft Wings. There are three Infantry Regiments and one Artillery Regiment in each Division. The Regiments are composed of Battalions which are the smallest self-supporting combat units. The organization of the Aircraft Wing is variable with a Headquarters Group, a Service Group, an Air Control Group, and two or more Aircraft Groups being the usual arrangement. The communications system follows this structure and each of these levels has a communications organization and a communications management function that are subsystems of the communications system. The communications system extends below the Group and Battalion levels in the form of users, but there are no management functions involved. At each higher level in the organization, the communications system becomes larger, more complex, and more difficult to manage simply because the organization supported is larger and the mission is broader. An added problem dimension is created when the ground and aviation units are combined at a level lower than the MAF.

There are three channels of information flow within both the total system and the communications system. The first is the command channel which follows the chain of command that descends

directly from a commander to his immediate subordinate commanders. A staff officer can act in the command channel in fairly narrow areas as prescribed by the commander.

The next path of information flow is the staff channel. This means is wholly contained within a headquarters and consists of the means by which the commander issues instructions to his staff and in turn is used by the staff to submit recommendations and provide detailed information to the commander [Ref. 29].

The third channel, the one that often proves to be most useful, is the informal channel. This one encompasses all of the staff to staff, staff to subordinate, and staff to senior links that are established external to the command channel. Although completely unofficial in the sense of strictly formal authority relationships, the instructions passed in the informal channel often become highly directive in nature. The contents of this channel are usually more informative, more specialized, and less structured than in the formal channels. The tapping of this lucrative source is one of the most difficult and challenging tasks of the system designer.

B. OBJECTIVES OF THE COMMUNICATIONS SYSTEM

1. The Mission of the Communications System

The purpose or mission of the Marine Corps communications system is to provide the commander with an effective means to command subordinate and attached combat units and to coordinate the

efforts of combat support and service support units to achieve maximum combat power in the offense or defense. There are four fundamental requirements for effective communications: reliability, security, speed, and flexibility. The objectives of the communications system are technical measurements of these requirements and important supporting attributes [Ref. 30].

2. The Specific Objectives

The first objective is speed of service. This is an all-important feature of any military communications system since situations develop very rapidly and time lost in transmitting an order can have disastrous results. Because different parts of the system have different characteristics, there must be different measurements and standards developed for each. Examples of speed measurements that would be employed are connection time for calls at a telephone switching center, the time required to transmit information measured from the time it is introduced into the system until delivered to the user, and the installation time for a component of the system. Since the general objective is overall speed of performance of the entire system, the standard of each component must be assigned so it contributes to achieving the general objective [Ref. 31].

The next objective is quality of service. It is all well and good to deliver a message with close to zero time delay, but if the message is unintelligible nothing has been gained. The quality of service provided by a communications means is measured in

quantitative service factors such as voice intelligibility, error rate per unit of measure of data, and distortion levels on teletypewriter circuits. Again each component would have a different standard and method of measurement that contributes to the overall objective of providing high quality service. This objective is increasing in importance as greater reliance is placed on digital transmission techniques which require a higher level of circuit quality than straight analog techniques [Ref. 32].

The next objective, reliability of the system, is often considered to be paramount since it is the degree of continuity of service provided. The measure of reliability is expressed as a ratio of time the component of the system is available for service compared to the total time in operation. In this case, one type of measurement is suitable for all components but with different standards that take into account the basic differences in transmission medium.

Readiness of the system is the next objective. In contrast to the objectives previously discussed, readiness is a subjective measurement. The percentage of equipment available and operational, the percentage of authorized personnel on board, an estimate of the state of training of personnel, and a general estimate by the communications manager are the criteria presently used for evaluating readiness. The standards applied to this objective are arbitrary levels in each of the areas mentioned. The means of measuring and

quantifying the state of readiness are not well defined. Difficulties arise because there are many factors that affect the elements noted which cannot be isolated, therefore are not even indirectly considered. This is one area that requires a great deal of additional study to remove as much as possible the subjectivity encountered.

Another important objective of any tactical communications system is flexibility. This again is somewhat subjective because this cannot be fully assessed until a situation arises that tests this factor. The goal is to have a system that will meet the needs of the tactical unit under all conditions and in all circumstances. This is mostly a design goal, the capability to satisfy the objective must be designed into the system from the beginning [Ref. 33].

There is a factor included under flexibility, namely compatibility, that approaches the importance of an objective. This term is usually applied to equipment design which is not under the direct control of the communications manager at any level considered. However, the same criterion can be applied to communications systems design so the flexibility of the system is increased. This factor will become a system objective in the future under the direction of a Joint Chiefs of Staff agency established with the sole purpose of insuring all military tactical communication systems are compatible.

The next objective of the communications system is security. The stated objective of the Department of Defense is total security on

all circuits down to the lowest tactical levels. The security should extend from the originator of the message to the recipient. The impact of this objective on all future tactical communications is tremendous, since concepts and procedures that have been standard for many years will be radically altered. The impact on the present system is just as great but in a different way. The economic feasibility of adding encryption equipment to every circuit under present budgetary constraints is questionable. In addition, the operational feasibility of voice encryption using present state-of-the-art equipment is poor without a serious degradation of the entire system. The precise measurement techniques and criteria for this objective are classified but they do exist in sufficient detail to make this a valid objective [Ref. 34].

The last two objectives are closely related. The objective of endurance is a measure of the system's ability to operate over extended periods of time measured in the number of hours that full operations can be conducted without external support. The main problems would be related to logistical support and the physical environment. The objective of survivability is a measure of the system's ability to continue operation in a hostile combat environment. The measurement is based on degradation of the system as compared to the capability of the fully operational communications system and the amount of time required for the system to return to full operational

capacity after a major degradation. These objectives are difficult to assess until a situation that tests them occurs.

There are other objectives stated for the communication system that are developed to guide a local program or are oriented toward a specific subsystem of the communications system such as an air control communications network. They are not included since only broad objectives that apply to the entire tactical communications system are needed. It is their broad scope and stability that make them an excellent base for an information system.

C. THE ROLE OF THE MARINE CORPS COMMUNICATIONS MANAGER

1. The Managerial Position and Authority

The communications system can be fragmented into elements which cause the system to function. The elements are personnel, equipment, procedures and management. The focus is on the last element, management, which in the Marine Corps is provided by a communications-electronics officer or communications officer.

This communications manager, by whatever name, performs all the classical managerial functions to some degree in his role as a staff specialist. In this role, it is his responsibility to provide the commander with the technical expertise to plan and operate the tactical communications system required to support combat operations.

Marine Corps doctrine holds that communications is a command

responsibility, hence the commander, not the communications officer, must ultimately answer for the performance of the communications system. It is usual for the commander to charge the communications officer with providing the service and delegates the authority to him that is necessary to fulfill this responsibility.

The authority delegated to the communications manager is classified as functional authority, as contrasted to command authority, since it extends only to the area of specialized knowledge and operations. This authority is exercised by prescribing processes, methods, and even policy. These are issued in the command channel in the name of the commander and are subject to close scrutiny by the commander or his principal assistant [Ref. 35].

The communications manager functions a great deal in the informal channel of information flow so that the commanders are bypassed. This allows the communications manager at one level to converse directly with the communications manager of the senior or subordinate unit. In this informal channel there exists a chain of command and authority that, although not a part of the formal system, is just as structured and rigid as the formal system. The communications manager often uses this informal chain of command to provide operational control and coordination of the communications system.

At the lower levels, the communications officer is also the head of an operational communications organization, filling a command

and operational role. At the top levels, the communications manager has a small staff and functions strictly in a managerial role with no direct operational responsibility.

2. The Scope of Responsibility

The scope of the Marine Corps communications manager's responsibility includes all matters concerning or related to communications and electronics except the following:

1. All data processing systems and functions.
2. All electronic warfare systems.
3. All electronic equipment installed in aircraft as part of the basic avionics package.
4. All electronic equipment associated with weapons systems.
5. All electronic equipment associated with intelligence collection.
6. All functions of providing electrical power to any facility except the communication system.

Providing communications support for all of these activities is within the scope of the communications manager and can become the center of attention.

Although the communications officer is a technical staff specialist, the Marine Corps considers him to be an unrestricted officer and trains him accordingly. Because of this background,

there is more than just a passing acquaintance with the mission and functioning of the total system, enhancing the communications manager's capability. He is able to make a valuable contribution to operational aspects of the total system and is able to provide a better communications system because he understands the user requirements.

V. THE FUNCTIONS OF THE COMMUNICATIONS MANAGER

A. A GENERAL DESCRIPTION

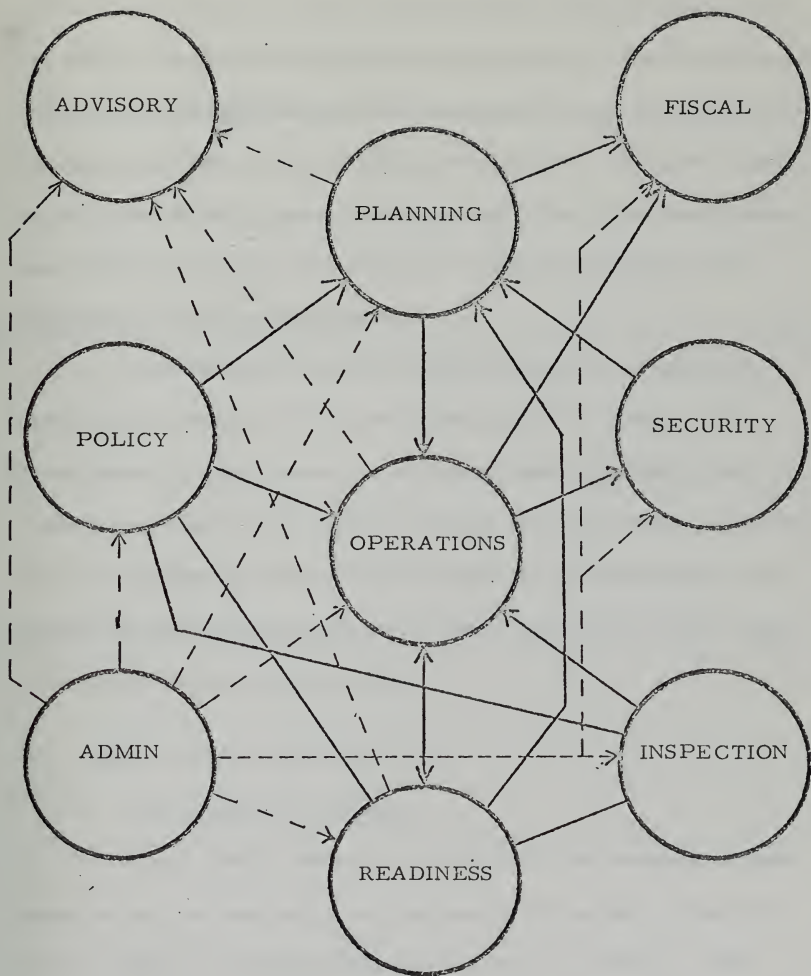
1. The Orientation and Dimension of the Functions

The functions of the Marine Corps communications manager are varied and far reaching but all are singularly oriented toward the communications system. The functions are not of equal importance, the different degree of emphasis and formality depends on the level of management. In some situations, one or more of the management functions may be eliminated for short periods of time, but as a rule all are performed since they constitute the key activities that cause the system to operate.

The job of a communications manager cannot be conveniently laid out in a sequential flow chart. It is multidimensional with the functions varying with time, operational situation, location, and many other minor factors. In addition, the functions are basically continuous and overlapping. Even with these difficulties, it is possible to identify and define these functions in a formal manner.

2. A Diagram of the Functions

Figure 1 shows the functions of a Marine Corps communications manager with the first and second order relationships between the functions expressed. First order relationship between two functions is defined somewhat subjectively as one function having a



— First Order Relationships

- - - Second Order Relationships

Figure 1. The Functions of the Communications Manager
showing First and Second Order Relationships

primary, direct effect on the second function in the sense that they are closely coupled and interact to a large degree. The second order relationships are defined in the same manner except the effect is a secondary and indirect one. These are directive relationships with the direction of effect shown by the arrow. If no connection between two functions is shown, it means there is little interaction, the functions are in effect decoupled.

In accordance with the analysis procedures established, detailed descriptions of these functions must be developed. The descriptions should indicate the elemental tasks or areas of activity, in sufficient detail so the outputs from the functions can be identified. The descriptions that follow do this where the elemental tasks are not too minute and detailed to be of value. If this is the case, only a general description is presented.

B. THE ADVISORY FUNCTION

1. Informing the Commander

When working strictly in a staff role, the communications manager has the function of advising and assisting the commander and his staff on communications and electronics matters. This function covers the entire scope of his responsibility and is continuous in nature.

The communications manager is charged with keeping the commander and his staff informed. Areas of interest include:

1. The general readiness of the overall communications system with emphasis on actual or potential problem areas.

2. The status of the operational communications system including general performance and usage figures, changes in capabilities, and pertinent information on any serious degradation of the system.

3. Recent changes in policy, procedures, or configuration promulgated by a senior headquarters that impact on the communications system.

4. The introduction of new major items of equipment.

5. Major changes in internal policy and procedures.

6. Persistent problems that do or can have a major impact on the communications system.

2. Inputs to Tactical Control

Technical knowledge, supplemented by a general background, qualifies the communications manager to provide inputs to strategic and tactical planning in the area of operational control of subordinate units. These inputs are centered around:

1. Advising on the capabilities and limitations of communications units, electronics equipment, and operational communications systems.

2. The impact of contemplated schemes of maneuver and operational concepts on the communications support capability. He

must insure that the tactical plan adopted can be supported by the communications system or point out the parts of the plan that exceed the capabilities of the communications system and any tradeoffs that are possible.

3. General Assistance to the Commander

By doctrine the communications manager assists the commander in employing communications and electronics systems. In actual practice, only he has the expertise to prepare the plans and supervise their execution for the commander, therefore the communications manager dictates the employment of communications systems. This is a separate function and will be covered in detail later. Other elements to the task of assisting the commander are:

1. Providing the technical expertise to evaluate and analyze any programs, ideas, or queries generated by the commander and his staff that are within the scope of the communications manager.

2. Providing an input to the setting of objectives for the total system. This can be in the form of communications objectives or technically oriented advice.

C. THE POLICY-MAKING FUNCTION

1. Definition of the Function

As the acknowledged head of the communications system at any particular level, the communications manager has a function much akin to command which is based on the great deal of functional

authority delegated by the commander. This function is to establish policy and standardized procedures for the communications system. This extends to the total system in matters that directly affect the communications system.

2. Resource Allocation Policies

One of the tasks which is a part of this function is to establish policies to guide the efficient and effective use of resources. This is usually in the form of system configurations and employment doctrine that are optimized for the overall communications system.

3. Standard Procedures for the Communications System

Another task is to develop, publish, and update standardized technical procedures that will govern day-to-day operations of the system. These are usually presented in two documents, the Communications Operating Instructions (COI) which provides for technical control and coordination of the system and the Communications Standard Operating Procedures (COMMSOP) which establishes routine methods of installation and operation of the communications system [Ref. 36].

4. General Communications Policy

The communications manager must initiate directives concerning communications related matters that are not a specific part of the system. These usually pertain to the use, or misuse, of the communications system by the rest of the organization. These policies, originated by the communications manager, are issued in the command channel.

The policy making function is very broad, affecting all portions of the communications system. There are standard procedures, detailed instructions, and firm policy issued as a part of all functions of the communications manager. These particular tasks are covered separately because they are more general in nature and cross functional lines.

D. THE PLANNING FUNCTION

1. Planning Importance and Orientation

Planning is the all encompassing function that is an elemental task of most other functions and serves to unite the communications system. The process is carried on concurrently with all other activities and in parallel with the development of plans in other portions of the total system. It is one of the most important and demanding functions of a communications manager.

The planning function being addressed is specifically oriented toward operational communications systems. It is the process by which general operational requirements for the exchange of information which have been imposed on the communications system are translated into specific technical requirements. The technical requirements are satisfied within the constraints of equipment capabilities, tactical considerations, and support requirements [Ref. 37]. The process is culminated by configuring or designing an

operational communications system that will satisfy information exchange requirements.

The elemental tasks involved in planning are an actuating of the steps in the planning process. The elements are presented in a logical sequence that is not meant to be time ordered. The individual activities within the planning steps are fairly well ordered in time, but the steps occur concurrently.

2. The Steps in the Planning Process

The first task the communications manager must accomplish in the planning process is compiling information that will be or may be required while developing the plan. The information will be in many forms, some will be written, some will be verbal. In either case, great care must be taken to insure only factual, up-to-date information is collected. This is not a one time effort but extends through the planning cycle. As planning progresses, new and different information needs will be uncovered and must be filled. The collection effort is not always formal and can extend to all activities of the manager.

The first task for the communications manager in the planning process is to develop an estimate of the communications situation. This is a semiformalized thought process that is a logical, orderly examination of all factors affecting the accomplishment of the assigned mission. This is a continuous process that has the

purpose of selecting the optimum course of action from the various possible alternatives [Ref. 38]. There are several definitive actions that should be taken by the communications manager in formulating the estimate. They are:

1. Analysis of the mission assigned to the unit by the higher headquarters and a detailed study of the remainder of the plan to determine exactly what is expected of the unit and the communications system.
2. Analysis of intelligence reports to become familiar with the enemy military situation and capabilities.
3. Familiarization with the physical characteristics of the areas of operations and the political and cultural characteristics of the population in the area.
4. Familiarization with the existing situation from general, tactical, and strategic points of view.
5. Review of the readiness of the communications system.

The next step is one of the most difficult in the planning process. This task is the determination of the communications requirements of the total system. This should be a part of the estimate but is covered separately because of its importance. There is no concise, formal method of determining communications requirements. It is a process of identifying communications requirements from what the information exchange requirements appear to be. The

analysis of the unit's mission, the study of the requirements established by senior headquarters, communications doctrine, and direct contact with the users are all aids in this process. This step is where the experience of the communications manager becomes a large factor.

The next step the communications manager must take in the planning process is to evaluate the requirements and determine how the means available can best be employed to satisfy these requirements. This is a resource allocation and technical design procedure that matches equipment to requirements. To match the equipment and requirements, it is necessary for the communications manager to characterize the communications links that can be provided. This is done to fully describe the various alternatives that represent acceptable means of satisfying a requirement; implying the necessity also to characterize the requirements in a similar form to facilitate the matching with the means available. Once the characterization has been done, the communications manager should narrow his scope of selection for any given requirement to concentrate on only those means that can provide the required service. By an iterative process, the characteristics of the means are matched with the characteristics of the requirements. The means that provides optimum technical characteristics and represent efficient allocation of resources would be chosen.

A system configuration would be developed by this process that could reasonably be expected to satisfy the communications requirements.

Subsequent to the system configuration being developed, the communications manager must design coordination and control procedures that are tailored to the system. Like the previous step there is no formal method for developing these very important procedures. The communications manager must decide what degree of control he requires, then develop methods to exercise this control. In a similar fashion, the manager decides where he will require coordination and develop procedures that will insure the necessary coordination occurs. There are standard control and coordination procedures included in operational publications and directives issued by the communications manager. These are not sufficient because they are general in nature, indicating the need to be supplemented by detailed, specific instructions.

The next step the communications manager takes is to determine the logistics and service support requirements of the operating system. Items considered cover the gamut from food, water, and fuel to exotic, electronic repair parts. Support can extend from transportation to tactical security forces. Again there is no formalized way to determine these requirements, each system configuration will be different. In many cases the specific requirements cannot be determined in advance. Only the mechanisms for satisfying the requirements as they arise are established.

The communications manager's last step in the planning process is to prepare and publish the formal document that contains the formal result of these steps. This document is the method by which the subordinate units receive their direction and provide the control factor in the operation of the system. Since the plan is not static, the communications manager must update it as required by changes in any of the inputs.

E. THE OPERATIONS FUNCTION

1. Communications System Installation

The communications manager has the function of providing an operational communications system to support all of the activities of the total system. This could be considered the primary function of the communications manager with all other functions supporting it directly or indirectly. The basis on which a communications manager is evaluated is how well this function is executed.

The first task that plays an important part in the operation of a Marine Corps tactical communications system is the installation of the multitude of components that are required for the system to function. The complexity of the task is a function of the size of the system and the physical environment. It involves starting from nothing and building the entire complex. This task is characterized by the high degree of coordination of activities, tight schedules, and

large amounts of logistics support required. The installation is often hampered by an uncertain or unstable tactical situation.

2. The Communications System Operation

The second task is operating the equipment and facilities that make up the tactical communications system. This task overlaps with installation since each portion of the system is put into operation as it is installed. This task represents the actual day-to-day physical operation of all components of the system. The majority of the managerial activities revolve around logistical support functions and the manning of the equipment. Other activities that require a great deal of effort are radio frequency management and propagation predictions, call sign coordination, and directory and routing management. Included in these activities are technical considerations of antennas, interference, and electromagnetic compatibility. Except for these later items, this task should not occupy a large amount of the manager's time if the system is functioning well. Once the mechanisms to implement these tasks are set in motion, little should be required on a continuing basis.

3. Control and Coordination of the Communications System

The third task in providing an operational system is the one that occupies the largest part of a communications manager's time. This is the task of coordinating and controlling the elements of the system. Communications control is concerned with the optimum use

of the communications system and supporting resources to meet the system's objectives. The activities can be broken into two elements, systems control, and technical control.

Systems control is the exercising of centralized, general supervision over all the facilities and activities organic to an organization which are a part of an existing communications system. The primary elements of systems control are:

1. Acting as a point of contact for the coordination, maintenance, and operation of all transmission and terminal means of the communications system, particularly for external agencies.

2. Coordination of actions required for restoration of systems outages.

3. Directing emergency adjustments to the system that are required by the tactical situation.

4. Maintaining system records and historical performance data so that accurate reports can be submitted.

5. Conducting analysis of the system in an attempt to increase effectiveness and efficiency.

6. Monitoring of system performance and maintaining an accurate status of all components.

Technical control is the means of exercising centralized technical supervision over the operational communications system. It provides for a common interface between a communications

medium and the user and between different types of media. In a more practical case, this means providing the interface between the terminal employed by the user and the method of providing the required signal path. The majority of the activities associated with this task require access to the individual circuits that are being provided. The primary elements of the technical control activity are:

1. Supervision of transmission quality.
2. Coordinating with external agencies the technical supervision and operation of common circuits.
3. Directing the use of appropriate troubleshooting procedures and coordination of troubleshooting teams. . .
4. Supervising circuit restoration and the use of alternate circuit routes.
5. Maintenance of circuit and traffic diagrams, files, and logs.
6. Preparation of any reports that are required in this phase of operations.
7. Analysis of all factors involving circuit interruptions, failures, and disturbances [Ref. 40].

These tasks are present at all management levels in varying degrees. Installation and operation are primarily lower level tasks that come more under an operational manager classification which is analogous to the communications managers at lower organizational

levels. The control and coordination are concerns of top-level management, particularly when interfacing with organizations external to the tactical organization.

F. THE READINESS FUNCTION

1. Subfunctions with a Common Goal

The term readiness function is misleading. There is not a single readiness function, instead there are four closely-related functions that have a common goal of insuring the communications system is ready to perform any mission. Each of the four functions will be discussed individually.

2. The Maintenance Function

The communications manager has the function of maintaining the full capability and insuring operational readiness of the communications and electronics equipment within his scope of responsibility. This maintenance function is one of the most critical, problem-plagued areas the communications manager must face since the amount of equipment in any Marine Corps organization is limited and without the equipment, the system will not operate. It is a source of frustration because many factors that impact heavily on equipment availability are beyond the direct control or even the sphere of influence of the communications manager.

There are two primary parts to the maintenance function. The first element is the preventative maintenance performed on

equipment to maintain it in operating condition. The second element is the repair of equipment that has failed. These combine to become a materials management problem where schedules, evacuation of equipment, and time under repair become important considerations.

There are several tasks of the maintenance function that pertain to both of its parts. They are:

1. Establishing standardized maintenance policies and procedures, supplementing policies of higher headquarters, and issuing implementing directives for policies prescribed by higher headquarters. This has been covered as a separate function but is mentioned again here because it is a major consideration in establishing and operating a maintenance program.

2. Supervising the performance of preventive maintenance on the equipment that is operational and the repair of equipment that has failed.

3. Maintaining an adequate supply system to support the maintenance function. The communications manager does not operate the supply system, but he must be deeply involved with it to insure availability of spare parts. He must consider the impact of inventory levels, response time of the supply system, and authorized spare parts lists on his equipment.

4. Maintaining records that show the overall status of equipment.

5. Conducting analysis on the adequacy of equipment allowances and equipment reliability problems.

The maintenance effort is a service-oriented subsystem of the communications system and has an organizational structure with partial managerial functions. The communications manager acts in more of a supervisory role as far as day-to-day operations are concerned but closely monitors the maintenance system and its performance.

3. The Personnel Function

Another function that falls under a readiness heading is insuring the readiness of the personnel that are a part of the communications system. The communications officer is not a personnel officer but he does have a personnel consideration. The people, individually and collectively, are what make the system operate. They are too important for the communications manager to abdicate his responsibility to someone else. Consequently, the communications manager has assumed either formally or informally many functions of a personnel officer.

The personnel function is comprised of the following activities:

1. Monitoring of communications personnel strengths and critical shortages in all subordinate units.

2. Assignment of key personnel to a specific unit by name and other personnel by rank and military occupational specialty.

3. Evaluation of the performance of key communications personnel.

4. Analysis of the standard organizational structure to determine the adequacy of personnel strength and the validity of the mix of occupational specialties for each unit.

The objective of this facet of personnel readiness is to insure optimum utilization of personnel resources. There is another part that involves the individual and unit capabilities or skill levels.

4. The Training Function

The communications manager has a training function that entails operating a formal training program. There are several tasks that are a part of this function.

The first task is to insure that required communications and military training are conducted for personnel of the communications system. A portion of this is done by formal education programs that are established by the communications manager. A majority of the training is done with on-the-job training programs that emphasize practical knowledge.

A second task is education of personnel external to the communications system in proper use of equipment, proper procedures to be used, and in a general what-to-expect orientation to the system. This task can be quite touchy and requires a bit of diplomacy on the part of the communications manager.

The last task is to determine and monitor the skill levels of units and key individuals. This serves two purposes, to assist in evaluation of the units and personnel and to provide direction and feedback to the training program.

The training function is not a major concern in a tactical situation where the communications system is in continuous operation. This permits most training to be accomplished on the job. However portions of it must be continued, particularly in very technical areas, and when new equipment or procedures are introduced.

G. THE INSPECTION FUNCTION

1. The Technical Orientation of the Inspections

The communications manager in exercising supervision of the communications system has a function of conducting technical inspections of all communications and electronics activities within the scope of his responsibility. The technical orientation is emphasized because it is not a primary function of the communications manager to supervise the military performance of the personnel of the system. It is expected of him as a Marine officer but not related to his communications management function.

2. The Method of Inspection

The inspections can be formal, informal, or working inspections as appropriate to the situation. The primary objectives are to determine the level of readiness of a unit or component of the

system, to insure that correct procedures are being followed in operating the system, and to isolate present or potential problem areas. The method of conducting the inspection and the specific items inspected will vary from unit to unit and with the person conducting the inspection. However, it is a part of this function to insure inspections are conducted correctly so the unit and the communications manager gets an undistorted evaluation of the unit. The inspection function continues in a tactical environment, inspections are just not as formal or extensive.

H. THE SECURITY FUNCTION

1. Definition of the Function

Security is a function of the communications manager based on the system objective. For the purposes of this function, security can be defined as the protection of information and equipment resulting from all measures designed to deny access by unauthorized personnel. The measures are designed to insure that intelligence information is not derived from the possession and study of parts of the communications system [Ref. 41].

2. Types of Security Considerations

There are four types of security that must be considered by the communications manager. Physical security entails providing adequate physical safeguards for all classified material and adequate protection to communications facilities. Cryptographic security

consists of the proper use of codes and ciphers. Transmission security is observed by using correct operating procedure and equipment so that little information can be gleaned by monitoring active systems. Emission security is the elimination or suppression of spurious radiation from electronics equipment that can carry information [Ref. 42].

The execution of the security function consists largely of knowing the requirements established in directives issued by higher headquarters and implementing them in an effective manner. Problems can be created because the very strict requirements laid down by the high level headquarters must be followed precisely. For example, the communications personnel who account for and handle certain cryptographic material and equipment are required to have completed a specific, formal course of instruction. The communications manager must be concerned with security continuously in all phases of his duties because of the large amounts of classified information handled by the communications system.

I. THE FISCAL FUNCTION

1. A Developing Function

The communications manager has a fiscal function that correlates closely to business management. This function is not actually performed by the communications managers in most organizations at the present time, but under the impetus of the

Department of Defense, it is becoming more evident even in a tactical situation. This is not without good reason; the communications system is a high cost element in the total system so should be considered in budgetary planning. However, this function should be limited to the upper levels of management.

2. The Fiscal Responsibility

In the execution of the fiscal function, the communications manager participates in the analysis of communications resources contained in tentative fiscal guidance and provides recommendations as to the adequacy of the tentative resource levels. He conducts a review of the budget data to insure program balance and that resource requirements are consistent with current planning. Lastly, he develops cost estimates and conducts cost analysis of operational systems.

J. THE ADMINISTRATION FUNCTION

Like all managers, the communications manager has an administrative function. Although the function is relatively minor, problems that do arise can reach major proportions. This function covers clerical operations, correspondence, files, and the other miscellaneous jobs that may be assigned to him. At the higher levels of management the administration function is larger and includes the administration of a staff.

K. IDENTIFICATION OF THE ELEMENTS OF INFORMATION

1. The Information Element/Function Matrix

By using the procedure previously developed, the functions of a Marine Corps communications manager have been analyzed and the elements of information required to perform those functions have been identified. The elements are shown in Figures 2 through 7 in the form of an information element/function matrix diagram. The matrix form of presentation was adopted from an input/output matrix presented by Mudick and Ross [Ref. 43].

The matrix diagram representation is used because a larger amount of information can be displayed in a clear, compact manner; first, the elements are displayed in a logical order; second, the requirement for each element can be indicated for each function; and last, the degree of need for the element can be indicated.

The requirement for an element of information in a function and degree of need is indicated by a G for general requirement or an S for specific requirement in the box at an intersection of an element and a function. A general requirement is one where the information is required in the performance of the function but not in great detail nor within a short time frame. A specific requirement is one where the information is needed in detail within a short time frame to carry out the function. An open box at an intersection indicates either no need for the element of information in a function or such a low degree of need that it can be ignored for practical purposes.

G - General requirement												
S - Specific requirement												
Tactical Information	Advisory	Policy	Planning	Operations	Equipment Readiness	Personnel Readiness	Training	Inspections	Security	Fiscal	Administration	
Overall mission	S	G	S	G	G	G	G	G	G	G	G	G
Unit's mission	S	G	S	G	G	G	G	G	G	G	G	G
Task organization	G		S	G								
Type of operation	G		S	S	G		G					
Scheme of maneuver	G		S	S					G			
Location of units	G		S	S					G			
Location of command posts	G		S	S								
General locale of operation	G		S	G	G	G	G					
Physical environment	G		S	S	S	S	G		S			
Cultural environment			S	S		S	G		G			
Political environment			S	S		S	G		G			
Electrical environment			S	S	G	S	G		G			
Planning timetable	G		S		G	G		S			G	
Planning sequence			S								G	
Time of execution			S	S	S	S		G	S			
Time zones involved			S	S								
Adjacent units			S	S					G			
Supporting units			S	S					G			
Planned operations	G		S	G	S	G			G	S		
Enemy E. W. Capability	G		S	S		S	G		S			
Probability of use	G		S	S		S	G		S			
Degree of use	G		S	S		S	G		S			
Method of employment	G		S	S		S	G		S			

Figure 3. Information Element/Function Matrix -
Related Elements

[illegible]

Figure 4. Information Element/Function Matrix -
System Configuration Related Elements

G - General requirement S - Specific requirement	Advisory	Policy	Planning	Operations	Equipment Readiness	Personnel Readiness	Training	Inspections	Security	Fiscal	Administration
System Operations											
Report requirements	G	G	S	S	S			S			S
Records requirements		G	S	S	S	S		S			S
Status of system	S		G	S			G	G			
Status of each circuit	G			S	G	G					
Circuit performance	G			S	G	G					
Circuit configuration	G			S			G	G			
Specific siting requirements				S			G	G	S		
Location of major equipment	G		G	S				G	S		
Circuit standards		S	S	S			G	S			
Circuit usage	G	G	G	S						G	
Circuit restoration priority	G	G	G	S	G						
Manning requirements	G			S		S	G	G		G	
Command directory	S		G	S			G				G
Physical security requirements			G	S				G	S		
Restoration procedures		G	G	S			G				
Circuit testing procedures				S	G		G				
Radio propagation predictions			S	S		G	G				
Frequencies available			S	S							
Call signs assigned	G		S	S			G		G		
Frequency designators			S	S							
Message processing procedures	G	S	G	S				G	G		
Message transit time	G			S							
Message queue status	G			S							
Precedence handling procedure	G	S		S			G	G			
Classified handling procedure	G	S	G	S			G	G	S		
Transmission security			G	S					S		

Figure 5. Information Element/Function Matrix -
System Operation Related Elements

[illegible]

G - General requirements S - Specific requirements	System Readiness	Advisory	Policy	Planning	Operations	Equipment Readiness	Personnel Readiness	Training	Inspections	Security	Fiscal	Administration
Equipment availability	G		G	S	S		G	G		G		
Reason for nonavailability	G			G	S			G		G		
Maintenance												
procedures		S	G	G	S			G				
requirements			S		S					G		
priorities		G		G	S			G				
policy		S	G		S			G		G		
performance	G			G	S					G		
status	G				S							
echelon		G	G		S							
Test equipment												
distribution					S		G	G				
calibration requirement		G			S					G		
calibration schedule					S		G	G				
Inventory levels spare parts		G	G		S			S		G		
Inventory allowance list					S							
Requisition status					S							
Usage data					S					S		
Unit strengths	S					S						G
Critical shortages	S					S						G
Unit state of training	S					S	S	G				
Individual state of training						S	S	G				
Special capabilities of personnel	G					S	S					
Special limitations of personnel	G					S	S					
Qualification of personnel	G					S	S	S				
Evaluation of key personnel	G					S	S					

Figure 6. Information Element/Function Matrix -
System Readiness Related Elements

Professional Knowledge	Advisory	Policy	Planning	Operations	Equipment Readiness	Personnel Readiness	Training	Inspection	Security	Fiscal	Administration
Communications concepts											
Communications doctrine											
Communications technology											
Communications language											
Systems Design parameters											
Marine Corps organization	THERE IS A SPECIFIC REQUIREMENT FOR ALL OF THESE ELEMENTS OF INFORMATION IN ALL FUNCTIONS										
Marine Corps doctrine											
Marine Corps tactical concepts											
Marine Corps staff functioning											
Communications directives											
Communications publications											
Communications manuals											
Communications plans											
Communications objectives											
MOS structure											
Tables of Organization											
Tables of Equipment											
Format of communications plans											
Format of other directives											
Budget cycle											
Budget format											

Figure 7. Information Element/Function Matrix -
Professional Knowledge Elements

One disadvantage of the matrix display is that it tends to give the impression of isolated functions with relatively fixed information needs. This of course, is entirely wrong, the functions are performed by one manager and if an element of information is available in one function, it is therefore available for all functions.

2. A Categorization of the Elements of Information

In the matrix diagrams, the elements of information were grouped into categories that appear at the head of each matrix.

The categories used are as follows:

1. Equipment related information. (Figure 2)
2. Information related to the tactical situation. (Figure 3)
3. Systems configuration information. (Figure 4)
4. Systems operation and control information. (Figure 5)
5. Systems readiness information. (Figure 6)
6. Professional knowledge. (Figure 7)

The grouping scheme is used to provide order to the elements. The categories used as a base for the grouping are not artificial but arise from either a common source base or a common use base. The common source base is not used in the sense of one document, the common denominator is that the elements evolve from the same type of source. For example, equipment-related information is one category easily identified. The elements of information grouped under this category originate from many different specific

origins but they all have the common base of equipment. The same line of reasoning holds for the usage base, the elements grouped in this way are all used in a similar manner.

The categories used are not mutually exclusive, many elements could easily be placed in a different group. Neither are the dividing points thin, clear lines but more broad, gray areas. Even so the categories serve their purpose and would assist further analysis.

3. A General Assessment of the Elements of Information

A major factor that must be considered is that the list presented is purposely general in nature because of the reasons developed in Section III. It will not cover all situations because there are always specific circumstances where additional or different information is required. In addition, only recurring needs have been developed. It is not possible to anticipate the one-time requirements for any particular set of circumstances. However it is felt that most of these one-time requirements will fall within one of the general elements listed.

Along these same lines, it was interesting to note the differences expressed between experienced communications managers as to what their functions are and what information is required. It is readily apparent that there is no "right answer" when dealing with a group of human managers, each has his own

methods which often differ a great deal. However, it is impossible for an information system to be designed for each manager. What is required is a synthesis process that yields a system that will support the functions of a manager, not an individual, yet flexible enough to support the needs of the individual manager.

VI. CONCLUSION

An analysis procedure was adapted from information system technology for use in analyzing the Marine Corps tactical communications system. The approach to the analysis was based on management functions that are common to all levels.

The structure of the tactical communications system was examined with an emphasis on a systems approach and the flow of information within the system. General objectives were established for the communications system oriented toward increasing the effectiveness and efficiency of the system as a whole. With these as background, the functions of the Marine Corps communications manager were identified and sorted into elemental tasks. Descriptions of the tasks were developed to provide the basis for identification of the information needs of the manager. The general elements of information that have been identified were presented in a concise, matrix format.

This study was conducted as one element in the design of a computer-based information system that would support a Marine Corps communications manager. The design process does not stop here. There are many elements in the design cycle left to be accomplished that are beyond the scope of this study.

The study provides one answer to the problem of determining the information requirements of the manager, however, it is by no means the only one. In particular a more technical computer-oriented approach would result in a much different view of the managerial functions with different elements of information being identified. It is possible that an approach of this nature would use different methods for conducting the analysis.

The communications system is in a state of rapid change and expansion that is expected to continue for several years. Communications technology is advancing rapidly and management systems are steadily improving. Since the development cycle of an information system can extend over a period of from one to six years from initial inception to final implementation, the results of this study should be validated periodically during the design phase. It is possible as communications technology and military objectives change, that the functions of the communications manager will change enough to alter the elements of information.

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13. ABSTRACT

The increasing complexity of communications systems management is introduced and the framework for a solution to management problems is presented in the form of a management information system.

The role and value of information in an organization are shown so as to highlight the benefits of a well designed information system. The mission and objectives of an information system are defined to serve as guidance for the managerial aspects of the design effort.

A method is developed to analyze a system by identifying the general elements of information required by a manager around which a computer-based information system could be designed. This procedure is applied to the Marine Corps communications system, resulting in a detailed description of the functions of the communications manager. Further analysis determines the elements of information required to perform these functions.

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